AMENDED PATENT CLAIMS 31/10/2003

1. An optical measurement and inspection method comprising at least two light emitters, at least one light receiver, at least one signal generator connected to at least one light emitter and at least one light receiver and means for converting the received light to electrical current, **characterised in that,**

- a sheet of material lies or traverses between and/or in front of at least two light emitters and at least one light receiver (200),

- at least one signal generator controls at least one light emitter and at least one light receiver by sending them a synchronisation signal and thereby synchronises the emission and detection of light rays (205, 215, 245),

- at least one signal generator drives at least two light emitters with different carrier frequencies waveforms and/or phases, and at least one light receiver with both of these frequencies, waveforms and/or phases,

- at least two light emitters emit at least two rays of light (220),

- at least two rays are incident on the stationary or traversing sheet (225),

- at least two grazing, transparent and/or reflected rays of light from the sheet or directly from the light emitters are detected by the same light receiver (230),

- at least two rays of light are converted to photocurrent (240),

- the processed photocurrent and/or changes in the processed photocurrent are diagnosed and observed to find defects and/or determine characteristics of the said sheet of material (250).

2. An optical measurement and inspection method in accordance with claim 1, **characterised in that,** different beams from different emitters targeted to the same receiver measure different properties of the material sheet.

3. An optical measurement and inspection method in accordance with claim 1, **characterised in that,** the three dimensional structure of a defect is detected with more than one beams.

PATENT CLAIMS

1. An optical measurement and inspection method comprising at least two light emitters, at least one light receiver, at least one signal generator connected to at least one light emitter and at least one light receiver and means for converting the received light to electrical current, **characterised in that,**

- a sheet of material lies or traverses between and/or in front of at least two light emitters and at least one light receiver (200),

- at least one signal generator controls at least one light emitter and at least one light receiver by sending them a synchronisation signal and thereby synchronises the emission and detection of light rays (205, 215, 245),

- at least one signal generator drives at least two light emitters with different carrier frequencies waveforms and/or phases, and at least one light receiver with both of these frequencies, waveforms and/or phases,

- at least two light emitters emit at least two rays of light (220),

- at least two rays are incident on the stationary or traversing sheet (225),

- at least two grazing, transparent and/or reflected rays of light from the sheet or directly from the light emitters are detected by the same light receiver (230),

- at least two rays of light are converted to photocurrent (240),

- the processed photocurrent and/or changes in the processed photocurrent are diagnosed and observed to find defects and/or determine characteristics of the said sheet of material (250).

2. An optical measurement and inspection method in accordance with claim 1, **characterised in that,** different beams from different emitters targeted to the same receiver measure different properties of the material sheet.

3. An optical measurement and inspection method in accordance with claim 1, **characterised in that,** the three dimensional structure of a defect is detected with more than one beams.

4. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** the intensity of at least one said emitted ray of light follows carrier signal waveform and received light ray is demodulated utilising the carrier waveform signal or another signal generated from the carrier.

5. An optical measurement and inspection method in accordance with claim 1 and 4 **characterised in that,** at least one carrier waveform signal is a sine wave, cosine wave, or a square wave signal.

6. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** the photocurrent is converted to voltage.

7. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** resulting photocurrent or voltage is amplified.

8. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** the resulting photocurrent or voltage is fed into a fault detection circuit (80) that comprises,

- means for summing 820, 823 a positive or negative threshold voltage value to the voltage signal entering the fault detection circuit,

- a low pass filter signal path (825),

- means for resetting the circuit (850).

-means for generating digital defect signal pulses 840, 843 when analog signals exceeding preset threshold values are produced by the demodulation- or synchronised detection circuitry of the inspection or measurement system,

9. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** the sheet material (410, 510, 610, 710) is paper, steel, plastic, metal, rubber, aluminium foil, copper foil, film, or coated metal sheet.

10. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** the location and/or size of at least one defect and/or other attributes of at least one defect and/or sheet width, thickness, length,

density, reflectivity, purity or other physical attributes of the sheet are derived from the said optical measurements.

11. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** one or more defects may feature aspects of the following: holes, pinholes, scratches, spots, stains, cracks, edge faults, streaks, surface faults.

12. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** at least one light detector (520, 570, 720) and/or detector module (430, 560, 630) and/or detector array (420, 620) comprises at least one photoelectric device (530, 730), lens (550, 750) and/or wave guide (540, 740).

13. An optical measurement and inspection method in accordance with claim 1 **characterised in that,** the signal generator drives at least two light receivers with different carrier frequencies, waveforms and/or phases.

14. An optical measurement and inspection arrangement, comprising at least two light emitters, at least one light receiver, at least one signal generator connected to at least one light emitter and at least one light receiver and means for converting the received light to electrical current, is **characterised in that,**

- a sheet of material (410, 510, 610, 710) is arranged between and/or in front of at least two light emitters (400, 500, 600, 700) and at least one light receiver (420, 520, 620, 720),

- at least two light emitters (400, 500, 600, 700) are arranged to emit at least two rays of light incident on at least one sheet,

- said at least two grazing, transparent and/or reflected rays of light are arranged to be detected by the same light receiver (420, 520, 620, 720),

- at least one ray of light is arranged to be converted to photocurrent by at least one photoelectric device (530, 630, 730)

- at least one signal generator is arranged to control at least one light emitters (400, 500, 600, 700) and at least one light receiver (420, 520, 620, 720) by sending them a synchronisation signal and thereby synchronises the emission and detection of rays,

- at least one signal generator is arranged to drive at least two light emitters with different carrier frequencies, waveforms and/or phases, and at least one light receiver with both of these frequencies waveforms and/or phases,

- the photocurrent and/or changes in photocurrent are arranged to be diagnosed and observed to find defects and/or determine characteristics of the said sheet of material (310).

15. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** different beams from different emitters arranged to be targeted to the same receiver are arranged to measure different properties from the material sheet.

16. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** the three dimensional structure of a defect is arranged to be detected with more than one beams.

17. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** the intensity of at least one said emitted ray of light follows carrier signal waveform and/or received light ray is demodulated utilising the carrier waveform signal.

18. An optical measurement and inspection arrangement in accordance with claim 14 and 17 **characterised in that,** at least one waveform signal is a sine wave, cosine wave, square wave –signal.

19. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** the resulting photocurrent or voltage is fed into a fault detection circuit (80) that comprises,

- means for summing a positive or negative threshold voltage value to the voltage signal entering the fault detection circuit 820, 823.

- a low pass filter signal path (825),

- means for resetting the circuit (850).

- means for generating digital defect signal pulses 840, 843 when analog defect signals exceeding preset threshold values are produced by the demodulation- or synchronised detection circuitry of the inspection or measurement system.

20. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** the sheet material (310, 410, 510, 610) is paper, steel, plastic, metal, rubber, aluminium foil, copper foil, film or coated metal sheet.

21. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** the location and/or size of at least one defect and/or other attributes of at least one defect and/or sheet width, thickness, length, density, reflectivity, purity or other physical attributes of the sheet are derived from the said optical measurements.

22. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** one or more defects may feature aspects of the following: holes, pinholes, scratches, spots, stains, cracks, edge faults, streaks, surface faults.

23. An optical measurement and inspection arrangement in accordance with claim 14 **characterised in that,** at least one light receiver and/or detector (420, 520, 560, 570, 620, 630, 720) comprises at least one photodetector (530, 730), lens (550, 750) and/or wave guide (540, 740).

24. An optical measurement and inspection method in accordance with claim 14 **characterised in that,** the signal generator is arranged to drive at least two light receivers with different carrier frequencies, waveforms and/or phases.